

Montgomery County Codes Analysis

Implementation Roadmap for Updates
to the Energy Conservation and Green
Construction Codes

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Introduction

The energy and green codes represent a significant, long-term cost savings opportunity for residents and businesses in Montgomery County because they set minimum energy efficiency requirements for specific characteristics of new and renovated buildings, including the building envelope, mechanical, hot water and lighting systems.

These codes are an important tool for Montgomery County to guide improvements in the building stock and deliver both energy and carbon emission savings. When efficiency is built into the design and construction of new buildings and major renovations, reductions in energy use and emissions over the life of the building can be assured. Strong codes result in buildings that cost less to own, reduce long-term energy burden, are more comfortable to occupy, and are more resilient during power outages. A strong, forward-looking code roadmap can also be helpful in providing clarity to the market regarding future expectations in the building design and construction industry. This creates consistency, which supports code usability and can improve compliance once the new local code is adopted. Adopting new construction codes will bolster a local clean energy economy and create local jobs. New construction codes will result in cleaner, more efficient, healthier, and more comfortable buildings, averted greenhouse gas emissions, improved local air quality and overall cost savings for the community.

In this report, New Buildings Institute (NBI) delivers a plan for implementation of code adoption to aid Montgomery County in meeting the goals set out in its Climate Action Plan.¹ This document is a follow up to an Analysis of Current Codes memo that was provided to Montgomery County in October 2022. This subsequent report recommends a timeline for code adoption as well as policy details and considerations during each of these code adoption cycles, context on how and when changes to the above-outlined codes and standards could be phased in or begin enforcement to ensure they have both maximum impact and are usable by the building community. It also provides graphic representation to County staff for scheduling and planning of current and future code cycles.

¹ Montgomery County Climate Action Plan, 2021, xix, <https://montgomerycountymd.gov/climate/Resources/Files/climate/climate-action-plan.pdf>

Montgomery County Climate Action Plan

The Climate Action Plan, published in 2021, is Montgomery County’s strategic plan to cut greenhouse gas (GHG) emissions to 80 percent of current emissions by 2027 and 100 percent by 2035.² As a component of the overall goal, **Action B7 recommends the building code to require all newly constructed commercial and residential buildings in the County to be net-zero energy, starting with the 2030 code cycle.**² Additionally, Action E-2 recommends requiring solar installations on new or extensively modified buildings. In order to meet this action, the county needs to take intentional steps in the interim code cycles to achieve net zero emissions by 2035. Moreover, Action B5 in the Climate Action Plan recommends an all-electric building code for new construction.⁴ Additionally, the Climate Action Plan outlines a goal to provide 100 percent zero emissions transportation options by 2035.³

To meet Actions B5 and B7, Montgomery County will need to adopt and amend the energy and green codes beyond the next model codes published, specifically the 2024 International Energy Conservation Code (IECC) and International Green Construction Code (IgCC), and most likely in adoption cycles beyond that. Moving toward a fully decarbonized building sector will require two components, building electrification and energy efficiency. Electrification refers to replacing direct fossil fuel use in buildings (e.g., propane, heating oil, natural gas for heating, hot water heating, cooking and other uses) with electric sources or preventing fossil fuel uses from being installed in the first place. It can also include provisions that cover the electrification of transportation by incorporating electric vehicle charging requirements. Neither the 2024 IECC nor IgCC will provide all the necessary measures for the County to meet the electrification and efficiency demands of its stated goals.

In November 2022, the Montgomery County Council passed the “Comprehensive Building Decarbonization” legislation (Bill 13-22) that will ensure all-electric building standards become part of the County’s building code no later than January 1, 2027.⁴ The legislation requires the standards to be prepared by January 1, 2024, and adoption to coincide with the County’s next code cycle. Bill 13-22 contains several exemptions for specific end uses and building occupancy types that each provide specific challenges in fully electrifying, listed below:

End Uses

1. Emergency systems
2. Energy production facilities
3. Buildings with permits submitted prior to effective date
4. Combined heat and power plants
5. Hospitals
6. Wastewater treatment plants
7. Major renovations
8. Additions to existing buildings
9. Gas fireplaces and grills

Building Use and Occupancy Types

10. Manufacturing or processing
11. Crematory
12. Life sciences
13. Commercial kitchens
14. Income restricted housing where permit applications submitted before effective date
15. Schools where permit applications submitted before effective date

² Ibid, 142. “A net-zero energy building is commonly defined as a building where the amount of energy consumed is equal to the amount of energy provided by on-site renewable energy sources, which are typically calculated over a calendar year.”

³ Ibid, 88.

⁴ Bill 13-22 - Buildings – Comprehensive Building Decarbonization. Montgomery County Council. <https://apps.montgomerycountymd.gov/ccllms/BillDetailsPage?RecordId=2754>

NBI's Building Decarbonization Code provides cities and states with adoptable code language that enables new buildings to transition off fossil fuels. The language in the Decarbonization Code, in combination with updates from adoption in other jurisdictions, can serve to support the implementation of Bill 13-22 in Montgomery County. The Decarbonization Code provides specific code language that is designed to be adopted alongside the 2021 IECC model and ASHRAE 90.1 2019 model codes.⁵ In new construction, heating and water heating systems that would have been powered by natural gas, propane or oil (e.g., combustion equipment) can more easily be swapped with electric heat pumps during the design phases. The language in the Decarbonization Code, in combination with updates from adoption in other jurisdictions, can serve to support the implementation of Bill 13-22 in Montgomery County.

Where efficiency remains a cost-effective resource, reduced energy consumption makes it simpler and less expensive to meet building's energy needs with renewable sources of energy. Reducing energy use results in lower utility bills, which is especially important for low-income households and communities of color who disproportionately experience higher energy burden. Research shows that efficient buildings have better indoor environmental quality and significant health and productivity benefits. Electric-only buildings running on renewable power emit no carbon and are safer and healthier than buildings with combustion equipment due to improved air quality and reduced carbon monoxide. Because the most efficient heating and water heating technologies generally are electric, electrification can also help lower utility bills.

Efficiency also reduces the stress on the grid as distributed energy resources and central (i.e., utility-scale) renewables are added. According to Bill 13-22, "the County Executive must submit a report to the County Council regarding the system capacity needs and investments required for an all-electric building code standard."⁶ The efficiency and grid integration code provisions recommended in this report will have positive impacts on reducing capacity needs.

The code adoption process for Montgomery County takes place in three stages: national model code publication, State of Maryland code adoption and finally local adoption. The International Code Council (ICC) develops new building codes on a three-year cycle. The International Green Code (IgCC) and International Energy Conservation Code (IECC) are the two most relevant codes in helping Montgomery County to meet the goals outlined in the Climate Action Plan.

In Maryland, the state sets minimum energy code requirements, although cities can participate and influence this process. The State of Maryland outlines this two-step process for adoption of new editions of building related codes:

1. After new editions of I-codes become available from ICC, the Department of Labor is required to adopt the new codes for the State within 18 months.
2. After the State's adoption, all local jurisdictions have up to 12 months to amend & adopt these new codes for local code enforcement.⁷

Currently the State of Maryland adopts both the IECC and IgCC as mandatory minimums for construction, and is on the 2018 version of the IECC and the 2012 version of the IgCC. Jurisdictions, including Montgomery County, have the authority to adopt more ambitious codes than adopted by the state. Montgomery County has already established its own code Green Code. In this instance, the County has prepared the building industry to become more familiar with higher performance building practices. Currently, Montgomery County has adopted amended versions of the 2018 IgCC, for new construction 5,000 square feet and larger and the 2018 IECC, for all buildings.

Code Adoption Process

5 Building Decarbonization Code, New Buildings Institute, 2021. https://newbuildings.org/wp-content/uploads/2021/08/Decarbonization-Code-Overlay_Aug2021_v6.pdf

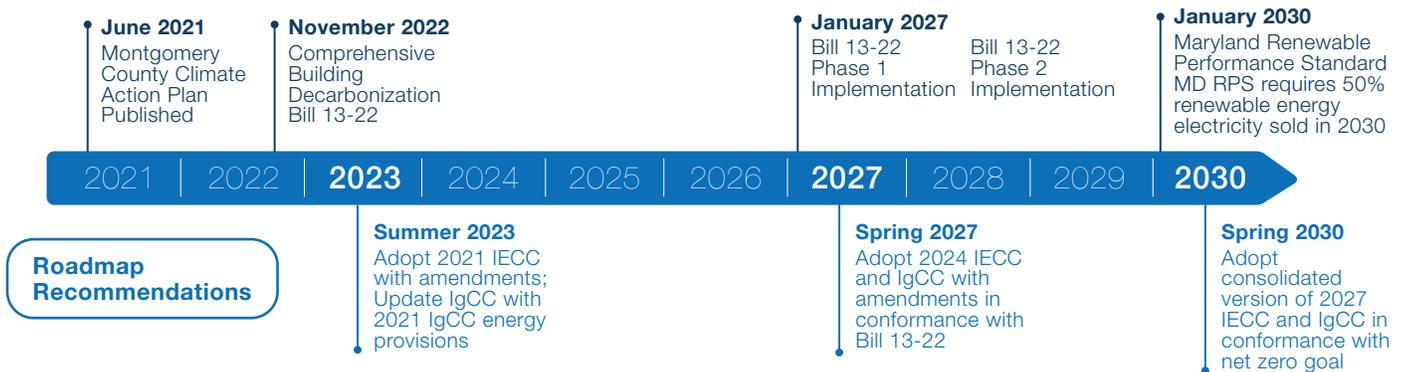
6 Bill 13-22 - Buildings – Comprehensive Building Decarbonization. Montgomery County Council. <https://apps.montgomerycountymd.gov/ccllims/BillDetailsPage?RecordId=2754>

7 Maryland Department of Labor, Division of Labor and Industry, Maryland State Building Codes - Building Codes Administration. <https://www.dlir.state.md.us/labor/build/buildstatecodes.shtml>

County Policy Timeline

NBI recommends the following code trajectory for Montgomery County. This pathway includes model code adoption, recommended amendments as well as additional considerations during the adoption process summarized below in Table 1. These recommendations are based on best practices in advanced code adoption jurisdictions around the country as well as current work in the model code development process.

Table 1: Code Timeline



Montgomery County Code Trajectory

A summary of the recommended code measures in each adoption cycle is outlined in Table 2 below. This path combines the best-in-class codes policies and experience from around the country with the recently enacted CBDA to put Montgomery County on the path to meet the building decarbonization goals in the Climate Action Plan.

	Current	2023	2027	2030
Energy Efficiency	Currently adopted base code and green code, as applicable	IECC: Additional Energy Credits; TPSR; Cool roof requirement IgCC: Improved zEPI scores	IECC: Improved ERI scores; advancements in prescriptive measures IgCC: Improved zEPI scores, approving net-zero	IECC/IgCC: Net-Zero construction that meets minimum efficiency performance target
Renewable Energy	IECC: No renewable requirement IgCC: Factored into zEPI score	IECC: Commercial renewable energy requirement; Residential solar Ready	IECC: Residential and Commercial Renewable Energy requirement	IECC: Apply procurement discount factors to RE; all building energy use is met with renewable supply
Electrification	None	IECC: EV charging residential and commercial; electric-ready new construction	IECC: All-Electric new construction (gas ban with exemptions takes effect Jan 1, 2027); increase EV charging; electric ready for remaining gas uses	IECC: All-electric new construction and major retrofits; expiration of exemptions; LMI housing sector effective 1/1/28
Grid Integration	None	IECC: Commercial and Residential grid integrated controls (thermostats, water heaters, and solar DR inverters); Energy storage ready	IECC: All major Commercial and Residential building systems capable of grid integration; Energy storage required	IECC: Minimum grid flexibility capacity to match grid peak periods for residential and commercial buildings

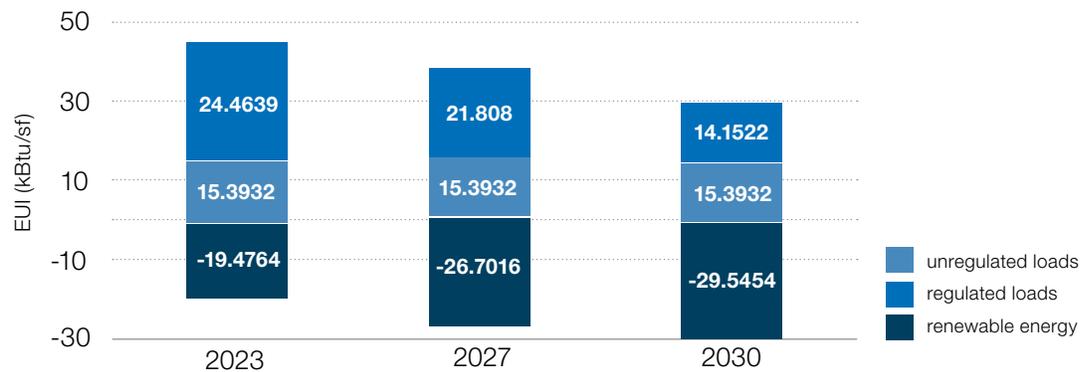


Energy Performance Modeling – Commercial

As part of the IgCC, the County requires compliance with a building-type specific Zero Energy Performance Index (zEPI) target. This zEPI score is a unitless scale for measuring commercial building energy use in the performance section of the IgCC. This allows comparison across building types and allows Montgomery County to chart a path to net-zero energy.

As part of updating the IgCC for Montgomery County, NBI recommends adopting the revised 2021 IgCC zEPI calculation methodology as it is published to replace the zEPI language now in Section 7.5. In addition, NBI recommends ratcheting down the zEPI score starting with 2021 IgCC performance values for each building type and getting to net-zero in 2030. The 2021 IgCC zEPI methodology (reflected in Equation 1) affords Montgomery County to select its preferred combination of efficiency and renewable supply on the path to net-zero by 2030. An overview of the progression of energy savings and renewable energy supply is in Figure 1: zEPI Progression below. Building type zEPI scores will be covered following the energy modeling description.

Figure 1: zEPI Progression to 2030



Currently, Montgomery County has a customized version of zEPI that applies the ASHRAE Appendix G modeling rules. NBI recommends moving to the standard 2021 IgCC zEPI methodology as published but customizing only the renewable and efficiency stringencies in 2021 IgCC. This IgCC formula accounts for regulated and unregulated loads independently. The zEPI achieves zero performance by also applying a renewable fraction variable which eventually becomes 100 percent to achieve net-zero energy.

$$zEPI = [BBUSE + (BBRSE \times BPF)] \times (1-RF) / BBUSE + BBRSE$$

Equation 1: 2021 IgCC Equation (Section 701.5)

Where:

zEPI = Zero energy performance index target required for achieving compliance with the standard, unitless.

BBUSE = Baseline building unregulated energy use expressed in source units.

BBRSE = Baseline building regulated energy use expressed in source units.

BPF = Building performance factor taken from Table 701.5.1 (7.5.1), unitless.

RF = Renewable fraction from IgCC table, unitless

The 2021 zEPI applies a source energy metric that gives preference to natural gas seen in Equation 1. Therefore, all-electric buildings need to perform substantially more efficiently than their mixed fuel counterparts to be deemed code compliant. In order to meet the efficiency and electrification goals that will support Action B-5, NBI recommends IgCC table ASHRAE 90.1 Addendum to be used with Appendix G. The zEPI calculation should be based on site energy also.

zEPI Scores in Green Code

NBI has calculated a recommended trajectory for each code cycle in order to meet the net-zero goal in the Climate Action Plan shown in Table 3 below. The 2021 IgCC calls for approximately half of total energy use from renewable energy for most building types. Given their much higher energy consumption, restaurants, hospitals and other healthcare buildings have lower renewable requirements at 35 percent of total energy use and at 10 percent for restaurants.

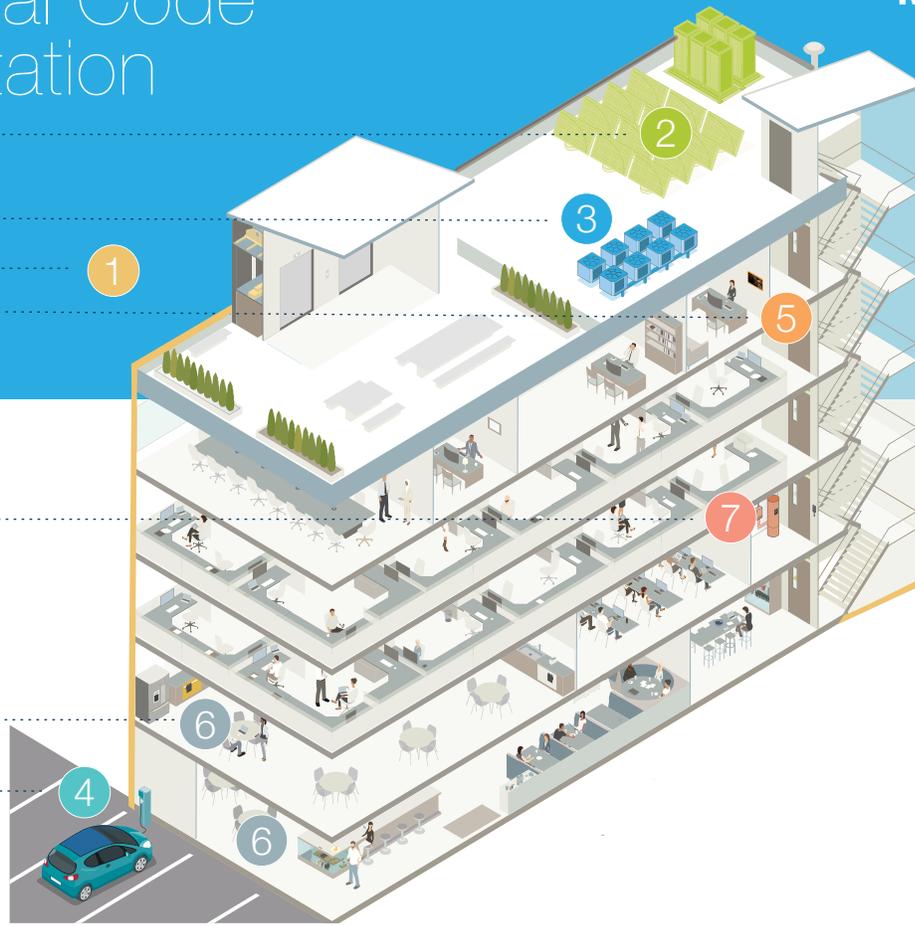
Table 3: NBI Recommended zEPI Trajectory⁸

Building Type	2018	2023	2027	2030
Multifamily	42	36	15	0
Health	45	40	17	0
Hotel/ Motel	50	30	14	0
Office	39	32	15	0
Restaurant	50	68	27	0
Retail	33	26	9	0
School	44	25	10	0
Semi-heated Storage	37	24	10	0
Other	42	36	8	0

⁸ The 2023 zEPI values are based on the 2021 IgCC. the 2030 net zero goal requires 0 zPEI score. The 2027 recommendations were calculated to meet the 2030 goal.



Commercial Code Implementation Roadmap



	2023	2027	2030
1 Building Efficiency	Reduced ERI scores, cool roof requirement	Reduced ERI scores, advanced prescriptive measures	Net-Zero construction minimum efficiency performance target
2 Renewable Energy	Solar Ready	Renewable energy requirement	Building load met with renewable energy
3 HVAC Systems	Electric ready HVAC Systems	All-electric new construction HVAC Systems	HVAC system replacement and retrofit all-electric
4 EV Charging	EV charging requirement		
5 Grid Integration	Grid integrated solar inverters and HVAC thermostats	Grid integrated major appliances	Minimum capacity for whole building demand flexibility
6 Appliances	Electric ready wiring near all gas appliances	All-electric appliances to meet fossil fuel ban	Appliance replacement and retrofit all-electric
7 Water Heating	Electric ready wiring near gas water heaters	All-electric new construction water heating.	Water heating replacement and retrofit all-electric



Energy Performance Modeling – Residential

Similar to the commercial zEPI score, residential buildings use an energy rating index (ERI) as a building performance score in the IECC. The ERI is a unitless scale for measuring building energy use based on climate zone where renewable energy can be factored in to further lower the value. Renewable energy for the purposes of the ERI is designated as part of on-site power production (OPP). To meet the performance goals outlined in the Climate Action Plan, NBI recommends also modifying the model code residential ERI scores to those values outlined in Table 4.

Table 4: NBI Recommended ERI Trajectory

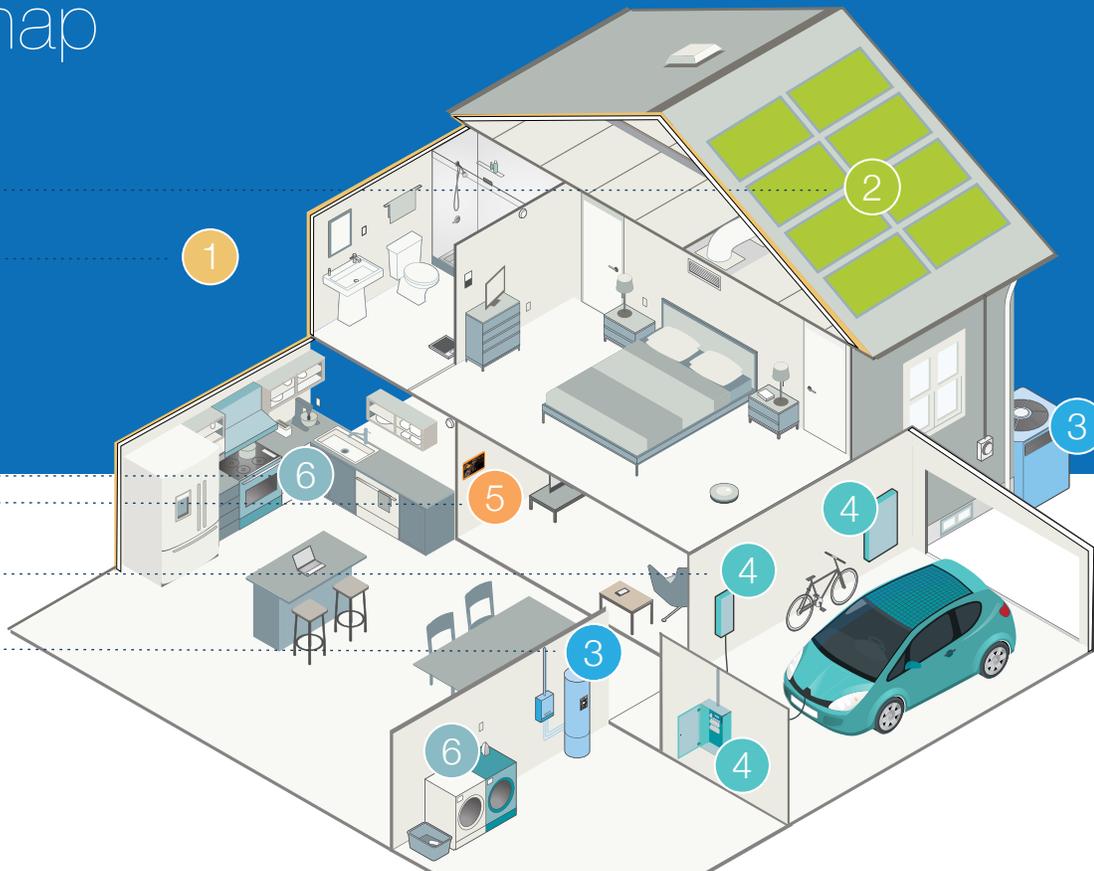
Building Type	2018	2023	2027	2030
Residential Buildings	62	53 without credit for OPP; 40 including OPP	42 without credit for OPP	42 without credit for OPP ; 0 including OPP

During the 2023 Montgomery County adoption cycle, NBI recommends amending the IECC's ERI to be 53 without OPP and 40 including OPP.⁹ This encourages on-site renewable energy while maintaining envelope and HVAC efficiency. This is equivalent to the 2024 Massachusetts Stretch Code for local adoption. For the 2027 Montgomery County code, NBI recommends an ERI of 42 without OPP included. For the 2030 adoption cycle, NBI would recommend a ERI of 42 before ERI and 0, or a 'net-zero' residence, with the inclusion of OPP.



⁹ On-site Power Production (OPP), energy produced on-site, most often photovoltaic solar in residential construction.

Residential Code Implementation Roadmap



	2023	2027	2030
1 Building Efficiency	Reduced ERI scores, cool roof requirement	Reduced ERI scores, advancement in prescriptive measures	Net-Zero construction minimum efficiency performance target
2 Renewable Energy	Solar Ready	Renewable energy requirement	Building load met with renewable energy
3 HVAC Systems	Electric ready HVAC Systems	All-electric new construction HVAC Systems	HVAC system replacement and retrofit all-electric
4 EV Charging	EV charging requirement		
5 Grid Integration	Grid integrated solar inverters, water heaters, and HVAC thermostats	Grid integrated major appliances	
6 Appliances	Electric ready wiring near all gas appliances	All-electric appliances to meet fossil fuel ban	

2023 Adoption Cycle:

2021 IECC / ASHRAE 90.1-2019 and 2021 IgCC

During the 2023 adoption cycle, Montgomery County will be considering 2021 IECC, 2021 IgCC and ASHRAE 90.1-2019. If state adoption of the I-codes is delayed, NBI recommends that Montgomery County expedite its adoption process as much as possible, despite having a twelve-month window to adopt. This would result in an estimated mid to late summer 2023 adoption of the 2021 IECC and IgCC. If Maryland does not include the 2021 IgCC in the state's update, NBI recommends Montgomery County adopt the 2021 IgCC energy sections as amendments to the 2018 IgCC.

In order to stay on track with the building priorities in the Climate Action Plan, NBI recommends the following local amendments to the model codes to align the codes with Climate Action Plan's transition schedule.

Energy Efficiency

Enhanced Energy Credits

Both the commercial (Section C406) and residential (Section R408) energy credit requirements are being revised during the 2024 IECC development process. In 2024, for commercial buildings, the 2021 IECC energy credit measures were expanded from selecting 1 of 8 alternate options to 15 available energy saving measures that can be flexibly selected to achieve 10 points (equivalent to 2.5 percent energy savings). PNNL developed building-type-specific credit values with a goal for the credits to achieve a total 5 percent energy cost savings. The energy efficiency credits in this roadmap are based on site energy use and each credit represents one tenth of one percent (0.1 percent) of building energy use which can be customized for a Montgomery County version of the 2021 IECC. For residential, an additional efficiency options section is also moving through the 2024 IECC development process, converting package options into a credit-based system similar to the commercial provision. The 2024 IECC residential provision requires projects to select additional efficiency "credits" equal to achieve a target of 10, representing the 10 percent energy savings needed from this section of the code.

For both commercial and residential buildings, NBI recommends that Montgomery County leapfrog the 2021 provisions and consider the language moving forward in the 2024 development process. An alternative option for commercial buildings from 90.1-2022 could also be considered.



Total System Performance Ratio

The HVAC credits in the commercial 2024 IECC are based on the Total System Performance Ratio (TSPR) which is a ratio that compares the annual heating and cooling load of a building to the annual energy consumed by the building's heating, ventilating and air conditioning (HVAC) system, providing a comprehensive performance-based approach for commercial HVAC system evaluation and analysis. This measure was first incorporated into Washington State's Energy Code in 2021 and a modified version is now included in addenda to ASHRAE 90.1-2019. Adding a TSPR requirement to the energy code ensures overall performance levels of HVAC systems and allows flexibility in meeting increased levels of carbon performance.

Installing a cool roof reduces the conduction of heat into the building, thus reducing the need for air-conditioning in conditioned spaces.

NBI recommends language in Addendum ag¹⁰ to ASHRAE 90.1-2019 be incorporated into the adoptions of the IECC and ASHRAE 90.1. With the legislation to move to all-electric construction in Montgomery County, NBI would additionally recommend using a heat pump baseline for the TSPR calculation methodology as this will correspond to the soon-required baseline equipment in Montgomery County.

Cool Roofs

A cool roof is a relatively inexpensive energy conservation measure to passively reduce cooling loads in warmer regions and reduce the health and community impacts of urban heat islands on both commercial and residential buildings. Cool roofs reflect sunlight and efficiently radiate heat away from the roof surface. Cool roofs are generally light colors like white or grey, but are also available in a variety of traditional colors by using cool-colored pigments. Installing a cool roof reduces the conduction of heat into the building, thus reducing the need for air-conditioning in conditioned spaces. Minimizing the need for air conditioning saves energy and money, and the decreased load helps to moderate peak grid demand during very hot days and heat waves, thereby reducing the risk of power outages.

NBI recommends updating the code language to cover Montgomery County's Climate Zone 4 for both residential and commercial construction.

¹⁰ ASHRAE Addendum ag, 2019. https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_ag_20220909.pdf

Renewable Energy

Action E-2 in the Climate Action Plan recommends requiring solar installations on new or extensively modified commercial and residential buildings. NBI recommends adding mandatory renewable energy requirements into the IECC, as the Green Code only applies to commercial buildings over 5,000 square feet. For this code cycle, NBI recommends a renewable energy requirement of 0.75w/ft² for commercial buildings, which will be the base level renewable energy requirement in ASHARE 90.1-2022.¹¹ This model code language provides exceptions for shading, orientation and obstructions.

For residential buildings, we recommend a renewable readiness requirement outlined in the Building Decarbonization Code.¹² This would require all new homes to be solar ready by requiring a designated 300 square foot minimum “solar ready zone” on the roof. Conduit and wire from this zone must be installed and space in the electrical panel must be reserved for a future solar array. Homes where solar is not feasible due to shading or not enough solar exposure due to orientation are exempt.

For flexibility, under certain conditions both commercial and residential buildings can procure offsite renewable energy from the PJM Interconnection electric service territory under a 15-year contract. This includes community solar facilities that provide local, clean energy through publicly authorized programs and such programs can also serve low-income communities. Unbundled renewable energy credits (RECs) can be substituted where both on-site generation and offsite procurement is not available to the project.

Additionally, NBI encourages Montgomery County to take into consideration the unique considerations around subsidized affordable housing. All residents in Montgomery County should benefit from the clean energy transition, however we do not want a renewable energy requirement to interfere with the construction of new affordable housing. As outlined in the Climate Action Plan, a County operated Green Bank or Community Solar facility could help support a renewable requirement for subsidized housing instead of creating exemptions for newly constructed units.

11 U.S. Department of Energy. “Prototype Building Models.” Accessed January 2022 via: <https://www.energycodes.gov/prototype-building-models>

12 Building Decarbonization Code, New Buildings Institute, Commercial p. 43-61; Residential p.99-116. 2021. https://newbuildings.org/wp-content/uploads/2021/08/Decarbonization-Code-Overlay_Aug2021_v6.pdf



Electrification

Electric-Ready New Construction

NBI recommends Montgomery County amend the 2021 IECC and ASHRAE 90.1-2019 to include electric-ready commercial and residential requirements. Having electric infrastructure in place where combustion equipment is being installed allows building owners increased choice to swap space heating, water heating, cooking and other equipment for electric equipment when it needs to be replaced, achieving higher efficiency, and reducing indoor air pollutants. This future-proofs buildings under the 2023 code to cost-effectively convert to all-electric in the future and creates the potential for a zero-carbon building. NBI recommends adopting pending addendum ac to ASHRAE 189.1-2020 into the IECC for commercial buildings. For residential buildings, NBI recommends integrating the electric-ready provisions in the Building Decarbonization Code.¹³

Charging

The Climate Action Plan outlines a goal to provide 100 percent zero emissions transportation options by 2035.¹⁴ However, the pace of EV charging station installations continues to be a critical barrier to widespread EV adoption. With the rapid growth of the electric vehicle market, it is demonstrably more cost effective to install charging infrastructure during new construction than during a retrofit. Knowing that the EV market penetration will be rapidly increasing over the next decade, as signaled by major car manufacturers' goals to end production of gasoline vehicles, three levels of preparedness are typically prescribed in current energy codes. The definitions below are moving forward in the 2024 IECC adoption process:

- **Electric Vehicle Supply Equipment (EVSE):** Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, personal protection system and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.
- **Electric Vehicle Supply Equipment Installed Space (EVSE space).** An automobile parking space that is provided with a dedicated EVSE connection.
- **Electric Vehicle Capable Space (EV Capable Space):** A designated automobile parking space that is provided with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity and panelboard or other electrical distribution equipment space, necessary for the future installation of an EVSE.
- **Electric Vehicle Ready Space (EV Ready Space):** An automobile parking space that is provided with a branch circuit and either an outlet, junction box or receptacle, that will support an installed EVSE.

13 Building Decarbonization Code, New Buildings Institute, 2021. https://newbuildings.org/wp-content/uploads/2021/08/Decarbonization-Code-Overlay_Aug2021_v6.pdf

14 Montgomery County Climate Action Plan, 2021, 88, <https://montgomerycountymd.gov/climate/Resources/Files/climate/climate-action-plan.pdf>

NBI recommends the commercial electric vehicle charging requirements moving forward in the 2024 IECC adoption process. New commercial parking facilities will be required to have 25 percent EVSE parking spaces, 5 percent EV-ready spaces, and 70 percent EV-capable spaces. Similarly, NBI recommends the residential requirements moving forward in the 2024 IECC to require one EV-capable space, EV-ready space or EVSE space for one- and two-family dwellings and 40 percent of total spaces be EV-capable spaces, EV-ready spaces or EVSE spaces for low rise multifamily buildings.



Grid Integration

Demand Responsive Controls

Grid integrated thermostats and water heaters support building decarbonization, and resilience needs by responding to fluctuations in grid load and contributing to efforts to manage supply increasingly based on renewable generation. Grid flexibility is one of the foundations for achieving meaningful decarbonization of the building sector as it can be an asset in decarbonizing the electrical grid. Carbon free energy sources like solar and wind have varying production over the course of the day and the year. System level controls that respond to demand response signals enable buildings to shape their consumption loads to better align with available low carbon energy production.

As efficient buildings and renewable energy generation are cited as key components of many jurisdictions' goals targeting carbon neutrality, a missing piece of the puzzle is how to modify energy demand during hours where renewable generation is not appropriately matched to the demand. To balance out variable supply and demand, NBI recommends requiring grid integration controls on electric water heaters and thermostats. Additionally, NBI recommends adoption of 2024 IECC pending language that requires floor space and electric capacity accommodating a future device capable of storing energy (storage-ready).

2027 Adoption Cycle:

2024 IECC / ASHRAE 90.1-2022 and 2024 IgCC

The Montgomery County 2027 adoption cycle will consider 2024 IECC and IgCC as well as ASHRAE 90.1-2022. During this cycle, Montgomery County will need to further amend the base codes to meet the goals outlined in the Climate Action Plan.

Energy Efficiency

Maintaining strong efficiency requirements will reduce strain on the electrical grid as the fossil fuel prohibition comes into effect during the 2027 code cycle. Performance based stringency levels for building energy use in 2027 are reflected in the commercial and residential modeling tables above. Additionally, technological advancement may allow Montgomery County to adopt more stringent standards. While additional prescriptive measures may need to be developed and modeled to align with the performance targets, NBI recommends the following measures be included in updates in the 2027 development cycle:

Airtightness Requirements

Airtightness is a critical feature of energy efficient homes and buildings and therefore, NBI recommends strengthening the airtightness requirements for residential and commercial energy codes. For residential buildings, NBI recommends an airtightness of 2.0ACH50 be adopted for new construction across all compliance paths. This has been shown to be cost-effective in Climate Zone 4 by PNNL analysis for the 2024 IECC development. Additionally, NBI recommends beginning to enforce air leakage testing on major residential renovations and targeting 3.0ACH50.

For commercial buildings, Addendum w to ASHRAE Standard 189.1-2020 increases the stringency of the airtightness testing requirement in Standard 90.1 and requires testing in more buildings. For most buildings, the air tightness requirement is lowered to 0.25 cfm/ft². Addendum w is approved so it will be incorporated into the 2024 IgCC, however NBI recommends including it in the IECC would ensure a wider range of buildings constructed in the County meet this air-tightness criteria, further preparing them for net-zero in the next code cycle.



Prohibit Electric Resistance Heating

With the implementation of the fossil fuel prohibition, ensuring that electric heating and water heating equipment is highly efficient will help. Heat pumps reduce electricity use by at least half when compared with electric resistance heating.¹⁵ NBI recommends the addition of language prohibiting or largely restricting the use of electric resistance heating for both space and water heating systems, with limited exceptions.

Increase Credits

Depending on the necessary adjustments needed to match the prescriptive path with the target performance of zEPI and ERI scores, NBI recommends Montgomery County consider increasing the number of points required to comply with C406 and R408, or move common construction practices out of the credits section into the base code, eliminating “free-ridership” and increasing the stringency of the prescriptive path.

In addition to the measure above, NBI recommends the consideration of additional prescriptive measures in the following published or upcoming documents:

- NYStretch-2023
- CA Title 24-2025
- ASHRAE 189.1-2023 and 2026
- Net Zero Roadmap to ASHRAE 90.1-2031

¹⁵ US DOE. Energy Saver Electric Resistance Heating <https://www.energy.gov/energysaver/electric-resistance-heating>



Renewable Energy

Building on the renewable energy requirements from the previous code cycle, NBI recommends expanding the renewable energy requirement to residential buildings. For this code cycle, NBI recommends a renewable energy requirement of 2w/ft², allowing both on site and PJM Interconnection electric service territory procurement off site under a 15-year contract. To potentially expand renewable requirements for commercial buildings, NBI recommends ensuring renewable energy updates to the 2024 IgCC and the 2027 IgCC are followed in full.

Electrification

All-Electric New Construction

Requiring all electric new construction directly aligns with Action B5 in the Climate Action Plan for an all-electric building code. As described above, the all-electric requirements in Montgomery County will be concurrent with the 2024 adoption cycle and will take effect in 2027. This bill largely or fully excludes on-site combustion in new construction with the exceptions described above. This rule will be adopted into Chapter 8 of the Montgomery County Code which will provide guidance to local code officials.¹⁶

In implementing this policy, NBI again recommends looking at the Building Decarbonization Code for specific code language. This includes full electrification of all heating, water heating and cooking equipment. In doing this, the County would need to amend the Additional Efficiency Requirements in Sections C406 and R408 to ensure savings against an all-electric building baseline.

Electric Vehicle (EV) Charging

NBI recommends an incremental step by expanding the electrical vehicle charging in single and two family to require one space to either have a full charging station (EVSE space) or EV-ready space. This means that at least one parking space has a junction box or outlet ready for an electric vehicle parking space. For commercial buildings, NBI recommends continuing to monitor both market demand and model code and policy language to adjust percentages of EV-parking requirements.

Grid Integration

Demand Response & Storage

NBI recommends incorporating additional building system grid integration measures to support greater penetration of all-electric residential and commercial buildings on the grid. We recommend demand responsive controls for EV chargers, stationary battery storage systems, and behind-the-meter renewable DC inverters when these systems are installed. Grid-integrated DC inverters will be required in the 2024 IECC for commercial buildings, but not required for residential buildings, however, NBI recommends including both in Montgomery County. Building on the storage-ready provision from the previous cycle, NBI recommends adding an energy storage requirement preferably sized to complement onsite when paired with onsite renewable generation, for both commercial and residential buildings.

¹⁶ Montgomery County Code. Chapter 8. https://www.montgomerycountymd.gov/DPS/Resources/Files/COMBUILD/Chapter%208_%20Buildings.pdf

2030 Adoption Cycle:

2027 IECC / ASHRAE 90.1-2025 and 2027 IgCC

During the 2030 adoption cycle, Montgomery County will be considering 2027 IECC and IgCC along with ASHRAE 90.1-2025. Not being able to predict the progress in the model codes, recommendations for this section will focus on meeting the targets outlined in the Climate Action Plan as benchmarks to amend the base codes as they are published. The most important consideration for 2030 Montgomery County adoption is that both codes should converge in energy performance at a net-zero level, either explicitly aligning the energy code and the energy chapter of the green code or merging the two under the energy code. Additional requirements for green buildings may be included.

Net Zero: Energy Efficiency Plus Renewable Energy

Energy Efficiency for Net-Zero Building Code

Action B7 in Climate Action Plan recommends the building code to require all newly constructed commercial and residential buildings in the county to be net-zero energy, starting with the 2030 code cycle. The Climate Action plans defines “a building where the amount of energy consumed is equal to the amount of energy provided by on-site renewable energy sources, which are typically calculated over a calendar year.”¹⁷ NBI recommends further county-specific analysis, like that done by both NBI and PNNL, to specify net-zero level of performance. This type of analysis leading up to this adoption cycle to determine the ideal energy efficiency levels for net-zero buildings.

Renewable Requirements

To meet net-zero requirements, renewable energy should balance out 100 percent of the building’s use on an annual basis. Where onsite renewable energy is not fully available, it is recommended that custom renewable offsite procurement factors be applied to support the most preferred renewable supply options. This likely would mean that renewable energy procured offsite through power purchase agreements and other contractual mechanisms would be calculated as a lower percentage of on-site production to encourage on-site renewable energy or local community solar when it is available. ASHRAE 189.1-2020 Addendum I provides model language of how a procurement factor may be integrated.¹⁸

¹⁷ Ibid 1p. 42

¹⁸ ASHRAE Addendum I to ASHRAE Standard 189.1-2020 https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/189_1_2020_I_20220729.pdf

Electrification **All-Electric Building Code for Major Renovations**

NBI recommends requiring all-electric replacements to existing gas equipment in buildings undergoing substantial retrofits and in additions to existing commercial and residential buildings. NBI has an Existing Building Decarbonization Code that provides model language.¹⁹ Existing commercial and residential buildings account for 26 and 24 percent, respectively, of greenhouse gases nationally.²⁰ The Existing Building Decarbonization Code is designed to cover additional and largescale retrofits, when the Energy Code is triggered. In addition, the Climate Action Plan recommends an incentive program to encourage more buildings to electrify. Beyond incentives, NBI recommends that the county eventually expand its all-electric requirements to all gas equipment replacements, either by energy code or emission standards for appliances and equipment.

Reduced carbon emissions over time in the PJM Interconnection territory will change the calculated trade-offs with on- or off-site renewable procurement options. It should be noted that the out-years in this Roadmap should serve as revised inputs to the optimum balances between efficiency, on-site renewables, off-site renewables and purchase grid electricity.

Grid **Demand Response & Storage** **Integration**

As a higher percentage of Montgomery County's building stock is fully electrified, and as the grid becomes more renewable-dependent, more building-grid integration will be necessary to mitigate carbon intensive peaking events. Expanding on the grid integration requirements from the previous cycle, NBI recommends commercial buildings be subject to regulation where efficient energy use, storage, on-site renewable and demand response are regulated as a system. At the time of the writing of this roadmap, these metrics and details are under development and not active in any mandatory US code or policy. As such, NBI recommends Montgomery County review best practices for standards with requirements for building-wide grid performance, such as peak demand response capability and overall building demand flexibility, in the development of the 2030 code.

19 Existing Building Decarbonization Code New Buildings Institute, 2022. <https://newbuildings.org/resource/existing-buildings-decarbonization-code/#:-:text=The%20Existing%20Building%20Decarbonization%20Code,comprising%2097%20billion%20square%20feet.>

20 Montgomery County Climate Action Plan, 2021, p, 131, 133. <https://montgomerycountymd.gov/climate/Resources/Files/climate/climate-action-plan.pdf>



Bethesda, Maryland

Codes for Climate™

Codes for Climate is an initiative of NBI to deliver the climate-aligned building codes and standards needed by U.S. states and cities in the face of the pressing demands of policy goals. To scale greenhouse gas reductions in the buildings sector to be in step with a 1.5°C future, the initiative works to support policy makers at multiple levels to move codes and standards forward, making significant reductions in energy consumption and GHG emissions from buildings possible and effective.

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New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings to make them better for people and the environment. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates, and building professionals—to promote advanced design practices, innovative technologies, public policies, and programs that improve energy efficiency and decarbonization of the built environment. Visit newbuildings.org to learn more.